

DRAFT – May 11, 2016

Status of Cadmus Research

Performance Evaluation of Combination Air Release/Vacuum Valves

The purpose of this research is to further EPA's understanding of the performance of the non-domestic combination air release/vacuum (CARV) valve (A.R.I. CARV valve) compared to CARV valves produced by other domestic and non-domestic manufacturers. This research includes a literature review, interviews with industry and academic experts, and possible interviews with representatives of wastewater systems and engineering firms from past AIS site visits. This technical memorandum provides a summary of information collected to date.

Updated Literature Search and Review

Cadmus identified several CARV valve-related references, in addition to those identified previously (Cadmus proposal dated April 19, 2016). These newly identified references include articles from peer-reviewed journals, completed graduate theses from academic institutions, industry-funded research reports, continuing education materials, and conference proceedings. An updated list of references is provided in Appendix A.

Based on available literature, it appears there are two operational issues regarding the reliability of CARV valves, namely, clogging and rapid valve closure causing pressure surges (Appendix B). Clogging can occur when food, oil and grease or other solids clog the valves causing them to cease functioning. Specific valve designs (e.g., conical bodies with large midribs, outward sloping walls, and funnel bottoms) reportedly prevent clogging. The A.R.I. CARV valve D-020 includes these design features.

Rapid valve closure occurs when the speed of water flowing toward the valve is very high and the valve orifices are not properly designed to accommodate the amount of air that needs to be discharged. To counter this effect, some designs include mechanical devices to slow the valve closure. Recent designs use a hydraulically piloted diaphragm instead of a float to control the rate of air release. This design feature may be included in A.R.I. valves (Zloczower, 2010). An independent laboratory demonstrated that A.R.I. valves reduced pressure transients during large-scale air release events (Apostolidis and Dudlik, 2005); however, Cadmus is currently not aware of any available comparative studies regarding different types (or brands) of valves.

Interviews with Academic and Industry Experts

Cadmus identified and contacted representatives of industry organizations and academic institutions to discuss types of CARV valves and CARV valve performance in the field. Industry organizations include AWWA, WEF, WERF, and WRRF. Academic institutions include University of Toronto, California State University, Sacramento, and Texas A&M Engineering Extension Service. During these discussions, Cadmus did not identify the name of the manufacturer of the non-domestic CARV valve or the names of any utilities that have requested waivers from American Iron and Steel (AIS) requirements in order to purchase the non-domestic CARV valve(s).